



Non-Intrusive Liquid Level Detection Technology



SUMMARY

Non-Intrusive Liquid Level Detection technology (NLLDT) uses infrared thermography to assay tanks and equipment for the presence of liquids. As such, liquid level information in tanks or equipment can be obtained for use in planning decommissioning activities.

The canyon deck of the 221-U Facility contains numerous vessels and equipment. The NLLDT System was deployed to assay selected equipment for the presence of liquid. This information was gathered in support of the Canyon Disposition Initiative (CDI) Project. The CDI Project is analyzing alternatives for the final disposition of the five large chemical processing facilities (canyons) at the Hanford Site. The 221-U Facility serves as the pilot facility for the CDI Project.

INNOVATIVE TECHNOLOGY DESCRIPTION

Non-intrusive liquid level detection technology is the use of infrared thermography coupled with either normal ambient temperature changes or local, low-level heating or cooling to passively and non-intrusively detect liquids in tanks and piping. Specifically, infrared imaging cameras are used along with specialized testing procedures to exploit physical property variations in the tanks/pipes and contained liquid and air to produce temperature contours of images that identify the liquid levels. Infrared thermography is the process of converting heat emitted from an object into a visible dynamic television-like picture.

The technology provides a non-intrusive method that can determine presence/absence of liquids in congested facility equipment.

BASELINE DESCRIPTION

Visual inspection, boroscopic visual inspection, and dipsticks are the baseline technologies for determining the presence or absence of freestanding liquids in facility equipment. Liquid detection in pipes is accomplished by finding low points and tapping the pipe for inserting sampling parts.

DEPLOYMENT DESCRIPTION

The NLLDT was deployed to detect liquids in a number of selected targets. Ten target vessels and a

number of piping assemblies located on the canyon deck of the 221-U Facility were selected for assay.

The deployment factors included the following:

- Capability to detect liquids in vessels and piping assemblies
- Capability to operate in a radiologically contaminated environment and to perform the demonstrations in such a way as to avoid contamination
- Ability to easily decontaminate equipment with conventional practices
- Capability of the computer and software for liquid level analysis.

Infrared and visual cameras were positioned to capture timed sequences of approximately 30 images per target. When required, external heat was applied to force temperature gradients. Images were analyzed using computer software to characterize the tanks or piping assemblies.

Deployment of the NLLDT was accomplished through the support of the Deactivation and Decommissioning Focus Area, which is managed by the Federal Energy Technology Center. This work was conducted as part of the 221-U Facility characterization in support of the CDI Project. Characterization information is being obtained to support a Record of Decision

for the 221-U Facility. The Record of Decision will establish regulatory and technical precedence for future disposition of the other chemical processing facilities (canyons).

DETAILS OF BENEFITS

The use of the NLLDT System to detect liquids in vessels and pipes eliminates the need to physically open and inspect these vessels. Risks to workers associated with gaining access to these types of objects and the possible exposure to radioactive or contaminated materials can nearly be eliminated.

Benefits measured in the deployment at the 221-U Facility are shown below.

Feature	NLLDT System	Baseline
Average setup time	30 minutes	7.9 hours
Inspection time	30 minutes	24 hours
Cost/tank	\$600	\$3,600

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